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Navy Case No. 76034

SIMULATED SUSPENDED MINE RETRIEVAL SYSTEM

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention generally relates to a system used in a retrieval process. More particularly the system is used in retrieving a deployed simulated mine wherein the mine is comprised of a buoy attached to an anchor by a tether.

(2) Description of the Prior Art

The Navy has sponsored numerous simulated minefield installations and retrievals to support both submarine and surface ship mine avoidance training exercises. The mines used in these simulations following recovery are used in future operations. The mines are deployed by attaching a spherical buoy, called a target, to an anchor with a tether. The prior art retrieval process is accomplished by either sending divers down to attach a cable to the target, attaching a surface buoy and cable above the target, or placing an acoustic release at

the lower end of the tether near the anchor. All of these procedures have serious problems associated with them. The diving method presents risks to human life, is extremely time consuming for a large minefield, and is limited to 130 ft. depths if the divers are using scuba equipment. The surface buoy procedure is not acceptable in many exercises because the ships using the minefield can become entangled. Acoustic releases, which acoustically disengage the anchor from the remainder of the system upon command, are expensive and put at risk of loss at sea when operated.

SUMMARY OF THE INVENTION

Accordingly, it is a general purpose and object of the present invention to provide an improved system for use in retrieving simulated mines deployed underwater. It is a further object that the system does not require personnel to be present in the water. A still further object is that the system obviates the use of surface buoys. Another object is the elimination of acoustic releases now sometimes in use. In addition, other objects are that the system be relatively inexpensive, efficient and easy to operate without requiring the use of highly trained personnel.

These objects are accomplished with the present invention by providing a system, towed from the rear of a vessel, that captures the simulated mine. The system has a first component that captures the simulated mine by encircling a tether line

that is present in the simulated mine and a second component that signals to the vessel that the capture has been made. The vessel is then stopped and the simulated mine is hoisted aboard.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description of the preferred embodiment taken in conjunction with the accompanying drawings in which:

FIG. **1** shows an operational arrangement of a simulated suspended mine retrieval system in accordance with the present invention;

FIG. **2** is an enlarged view of a spring loading shackle which forms a component of the simulated suspended mine retrieval system of FIG. **1**; and

FIGS. **3A**, **3B**, and **3C** show sequential operations of the simulated mine retrieval system of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Refer now to FIG. **1** where there is shown a towing vessel **10** having a winch **12** to adjust the length of an electro-mechanical tow cable **14** that is drawn over a pulley **16**. The electro-mechanical tow cable **14** has a fairing **18**. A waterproof load cell **20** for measuring tension is attached to the electro-mechanical tow cable **14** at the end of the electro-mechanical tow cable that is away from the winch **12**. The tensile loads at the

end of the electro-mechanical tow cable **14** are sent electrically up the electro-mechanical tow cable **14** and displayed aboard the vessel **10**. An additional two separate cables **22** are attached at one end to the load cell **20**. The other end of each of the cables **22** are attached to two respective Lateral Force Devices (LFDs) **24**. The two LFDs **24** are then connected to one another by two connecting cables **26** having a spring loaded locking shackle **28** connected to the connecting cables **26** at the ends of the connecting cables **26** away from the LFDs **24**.

Additionally shown in FIG. **1** is a simulated suspended mine **30** comprised of an anchor **32** a tether line **34** and spherical buoy **36**. The tether line **34** is of a length to keep the spherical buoy below the surface of the water **38** a distance to have the buoy, if it were armed, do optimum damage.

Refer now to FIG. **2** for a description of the spring loaded locking shackle **28**. The spring loaded locking shackle **28** is comprised of a substantially U-shaped bar **40** having a locking arm **42** with a torsion spring **44** affixed to one leg of the U-shaped bar **40** by a nut and bolt arrangement **46** so that the locking arm **42** is held in abutment with the inner portion of the other leg of the U-shaped bar **40**. The outer portions of the legs of the U-shaped bar **40** are connected to respective fittings **48** by a nut and bolt arrangement **50**. The fittings **48** have respective connecting cables **26** affixed to them.

Referring now to FIGS. **3A**, **3B**, and **3C** there is shown the retrieval operation of the inventive system.

In FIG. **3A** there is shown that when the suspended simulated mine **30** is approached, the tether line **34** attaching the buoy **36** to the anchor **32** contacts either the spring loaded locking shackle **28** directly or one of the two connecting cables **26**. When contacting one of the two connecting cables **26** the tether line **34** will slide toward the center to the spring loaded locking shackle. Anywhere the tether line makes contact between the two LFD's **24**, the spring loaded locking shackle **28** will seize the tether line **34**.

In FIG. **3B** there is shown that upon capture of the simulated mine **30** in the locking shackle **28**, the tension measured on the load cell **20** will increase drastically, and the ship is then directed to stop.

FIG. **3C** then shows the simulated mine **30** being hoisted on board the ship for use in future exercises. This procedure is repeated for each of the simulated mines **30** in the field.

Computer programs have been written to determine the length of the tow cable **14** that should be deployed to achieve a certain depth in the water column, based on tow cable diameter, tow cable weight, ship speed, and drag forces caused by objects attached to the tow cable. A plot of depth vs. ship speed can be created to give the approximate depth of the locking shackle **28** as it is towed through the water. A simulated suspended minefield (not shown) can be retrieved by towing the locking shackle **28** and its associated system through the area where the field has been placed, with the locking shackle **28** 10-20 feet

deeper than the depth of the suspended spherical buoy **36**. The tension measured on the load cell will be fairly constant during towing prior to capture and as mentioned previously will drastically increase upon capture of the simulated mine **30**.

There has therefore been described a system for retrieving simulated suspended mines **30** without using divers, surface buoys, or acoustic releases. The amount of time consumed by operation of this system over that of preparing for diving, having divers search for the simulated mine, and attaching a cable to the simulated mine **30** is greatly reduced. The elimination of acoustic releases from the simulated mine reduces equipment costs and the elimination of surface buoys reduces the risk of a ship becoming entangled and thereby damaged. The equipment used in this invention is relatively inexpensive and both safe and easy to operate.

It will be understood that various changes in the details, materials, steps and arrangement of parts, which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention.

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SIMULATED SUSPENDED MINE RETRIEVAL SYSTEM

ABSTRACT OF THE DISCLOSURE

A simulated suspended mine retrieval system is described. It snares a simulated suspended mine at sea that is comprised of an anchor, a buoy and a tether connecting the anchor and buoy. The retrieval system has a cable connected to a loop for snaring the simulated suspended mine. In operation the retrieval system is towed from a vessel and the loop passes over the mine and strikes the tether. When this happens the loop has a shackling arrangement that snares the tether and is of such a size that it cannot slip over the mine. This enables the simulated suspended mine to be hoisted upon the towing vessel.

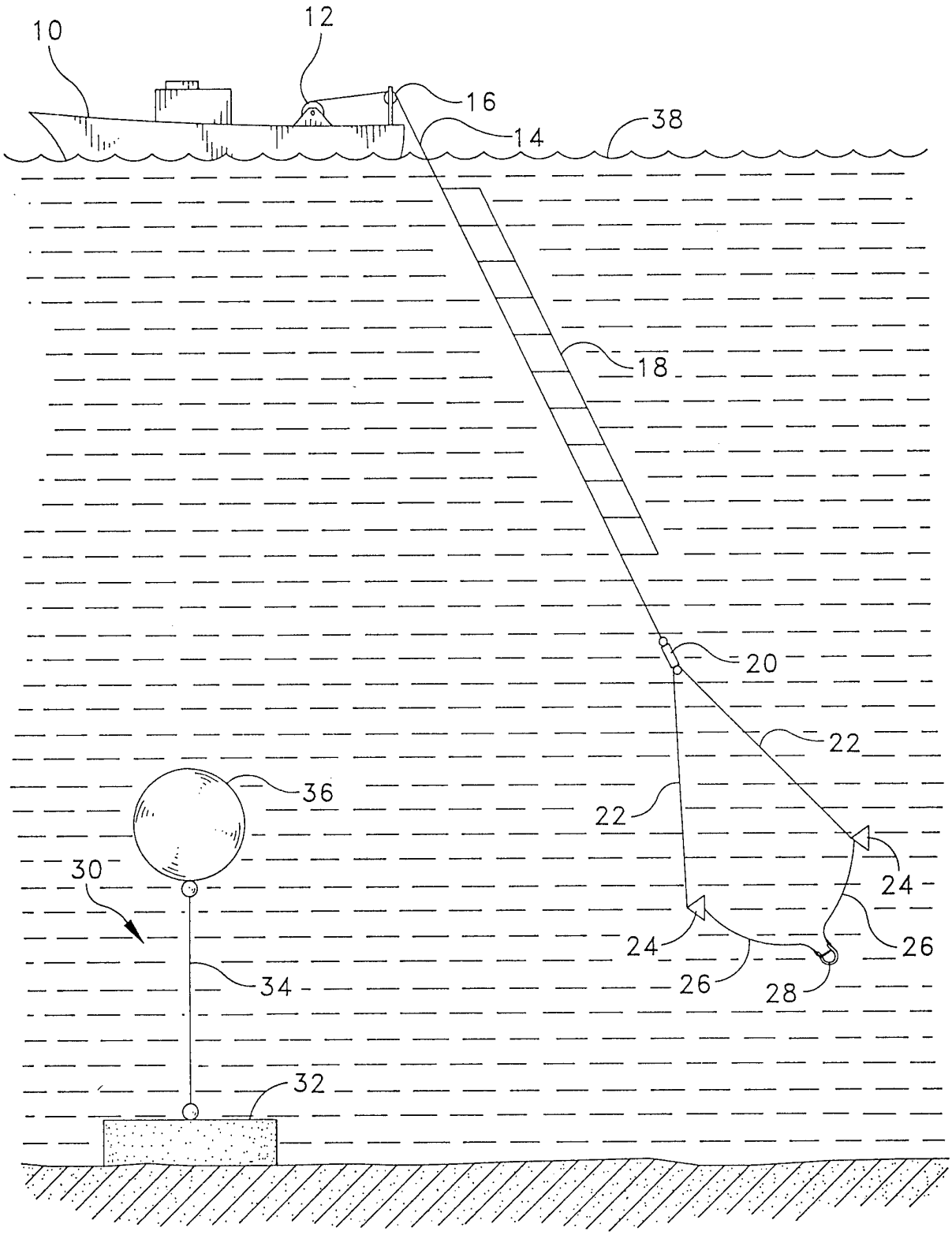

FIG. 1

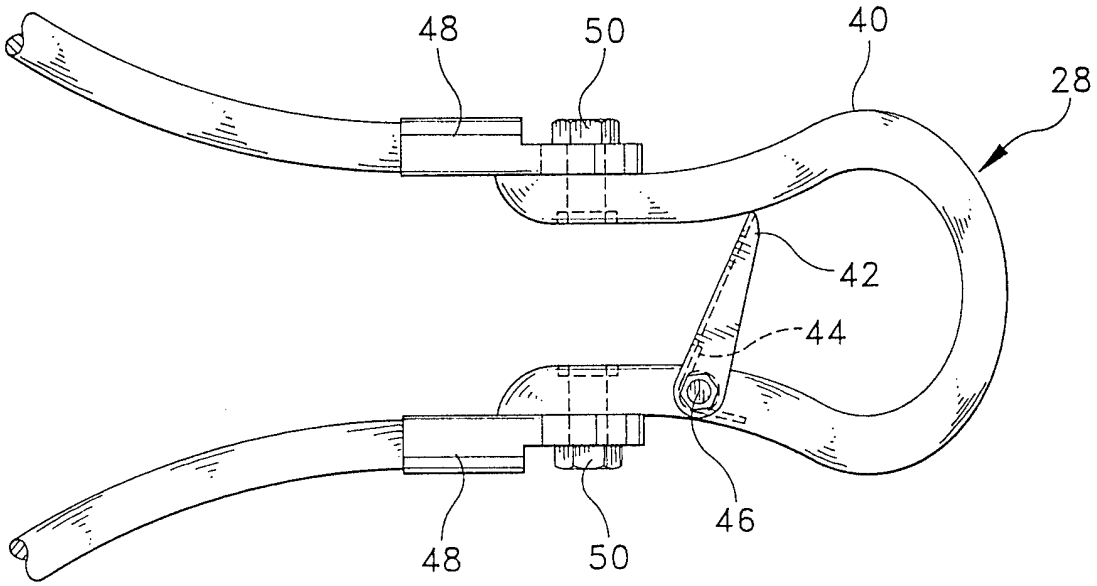

FIG. 2

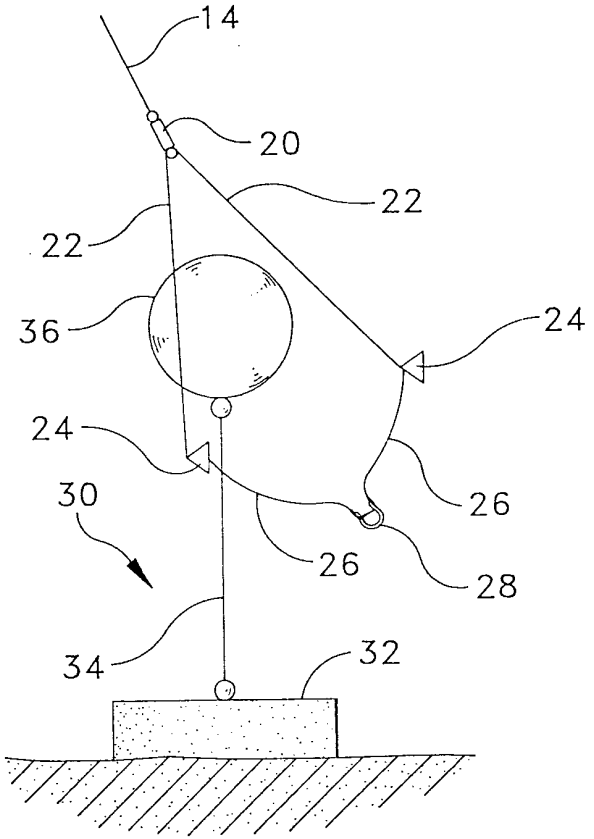

FIG. 3A

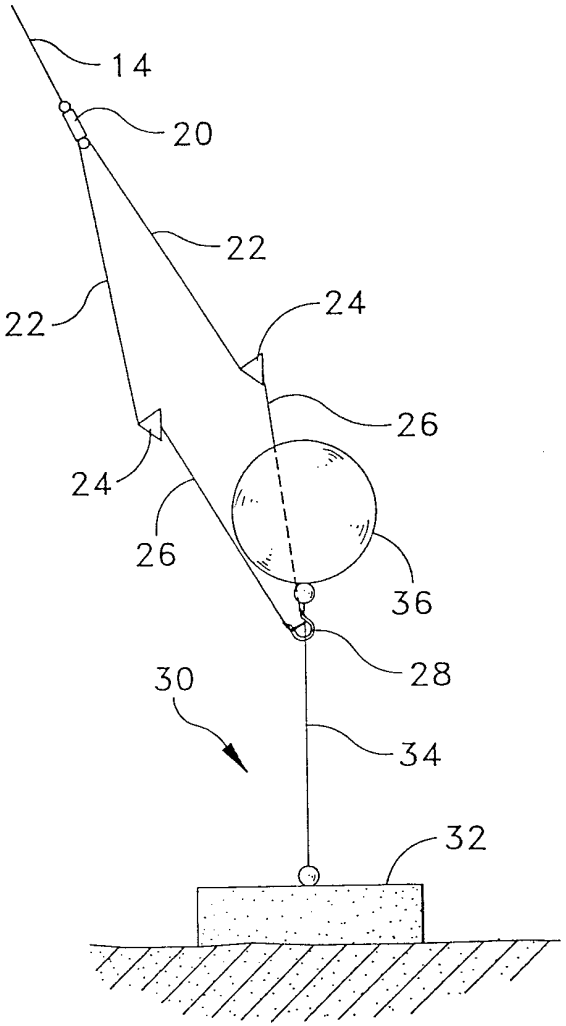

FIG. 3B

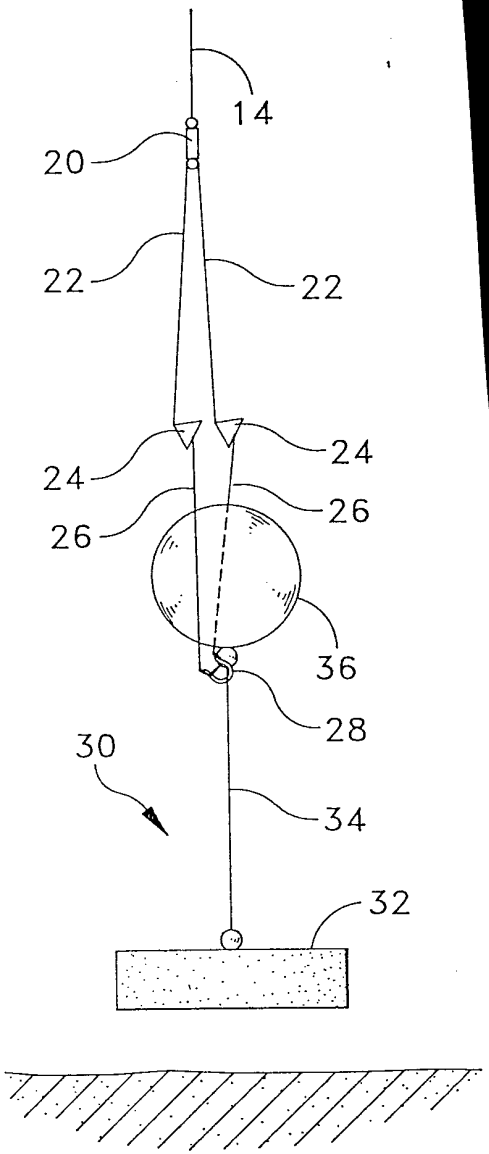

FIG. 3C